



Battle Creek Alliance

32065 Rock Creek Rd., Manton, CA 96059

(530) 474-5803

www.thebattlecreekalliance.org

April 6, 2017

Public Comment on “General Order of Waste Discharge Requirements for Discharges Related to Timberland Management Activities (Order) in the Central Valley region”

Dear Members of the Central Valley Water Board,

Battle Creek Alliance (BCA) was formed in 2008 due to concerns regarding the excessive logging which had begun occurring in the Battle Creek watershed in 1998. BCA has been collecting Citizen’s Water Quality Monitoring data since 2009 because we found that there was very little public data available to track the cumulative watershed effects of industrial logging in inland California watersheds. As of this date over 7,500 samples have been collected, including turbidity, both water and soil temperature, and water pH. This data has been analyzed by 5 different hydrologists in 2011, 2012, 2014, and 2016. These ongoing analyses show continuing deterioration, which the various regulatory agencies, including the Central Valley Water Board, have failed to take action to stop.

BCA has decades of extensive knowledge and experience of the watershed, and years of dealing with the regulatory agencies, the public comment process, and the legal system.

The Battle Creek watershed is a prime example of how the State Water Board’s timber rules have failed to protect the waters of the state in this, and other, forested watersheds.

We agree with your staff that changes are needed. Unfortunately, the proposed General Order does nothing substantive to address the root causes of the problems which are continually occurring in the forested watersheds of California.

1. Substantial evidence exists that current regulations are producing significant environmental cumulative effects.

Page 7 of your order states “The Central Valley Water Board, acting as the lead agency for this project under the California Environmental Quality Act (CEQA)(Public Resources Code, section 21000 et seq.), conducted an Initial Study in 2002 in accordance with California Code of Regulations, title 14, section 15063. The Central Valley water Board adopted a negative declaration pursuant to CEQA on 30 January 2003...”

However, a Negative Declaration can be prepared only when there is no substantial evidence in light of the whole record before the lead agency that the project may have a significant effect on the environment. ([PRC §21080\(c\)](#)), ([14 C.C.R. §15070](#)). Your Negative Declaration study was conducted 15 years ago. There have been substantial changes in those 15 years. The negative declaration is outdated and irrelevant to current conditions, which in turn means that CEQA's requirements are not being met.

As just one example of significant changes, consider the Battle Creek watershed.

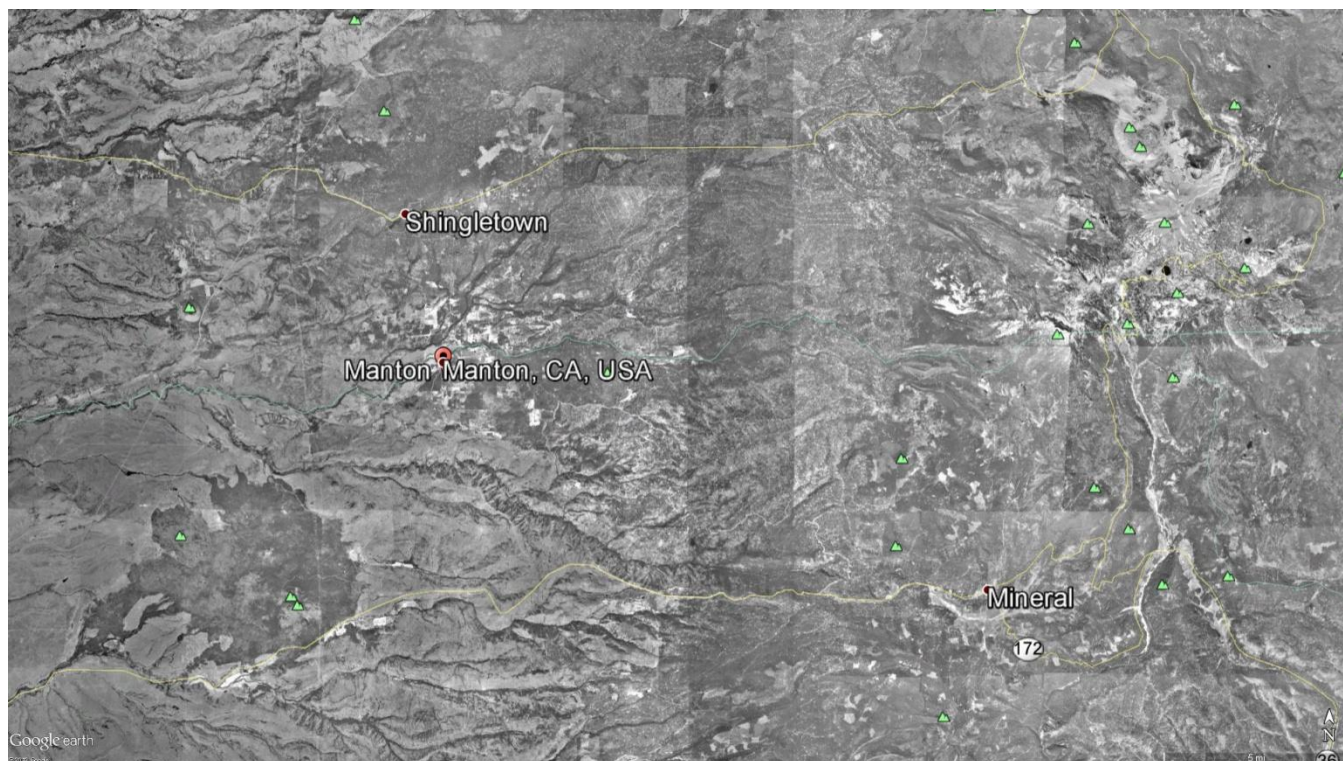


Figure 1. The Battle Creek watershed in 1998, before clearcutting and salvage logging.

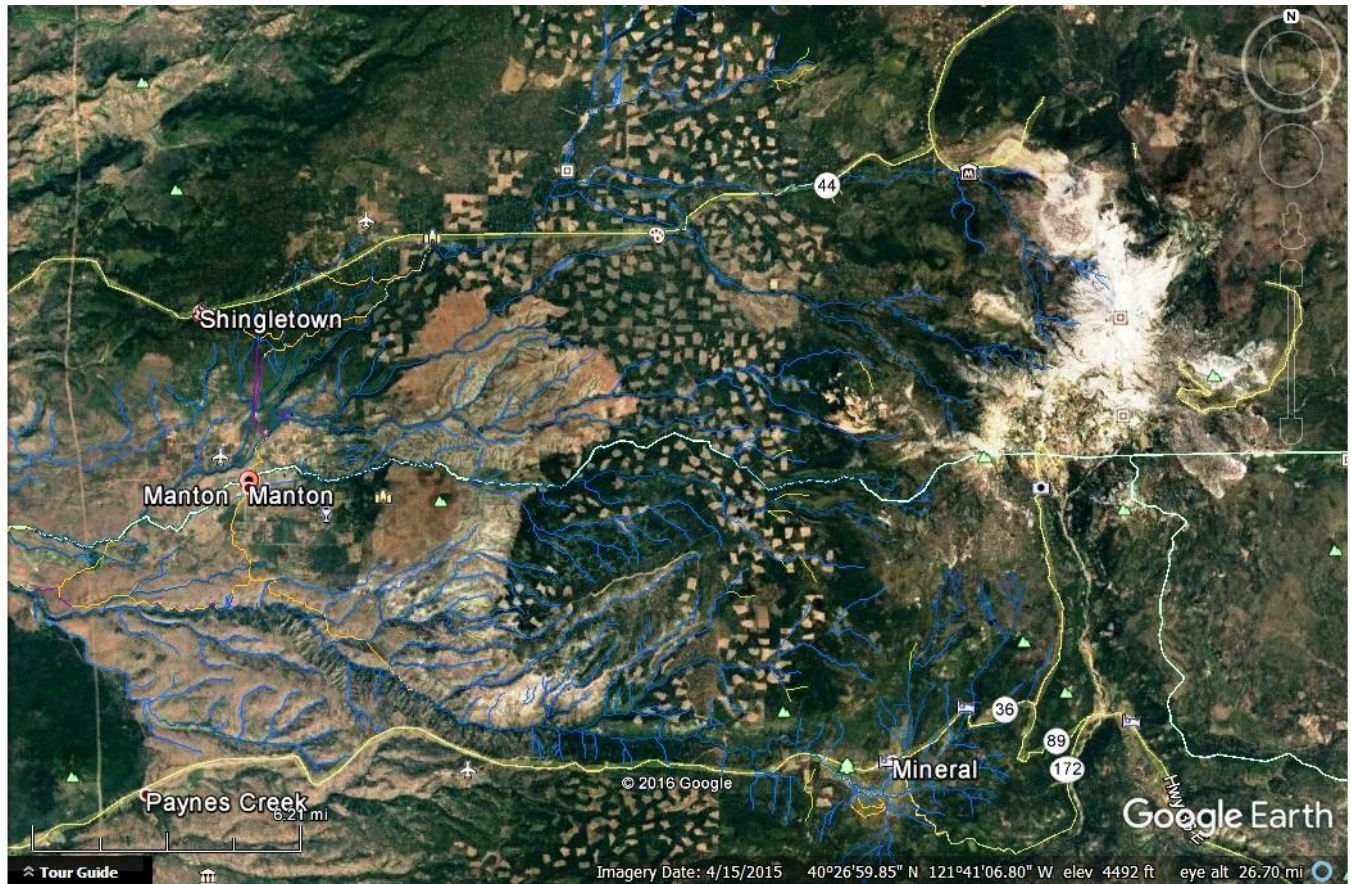


Figure 2. The most recent (2015) image of the Battle Creek watershed post clearcutting and salvage logging following the 2012 Ponderosa fire. The brown boot shape to the left of center is the fire and salvage logged area. The regularly spaced brown holes are clearcuts. The blue lines are the USGS National Hydrography Dataset flow lines which show the many larger streams flowing (generally) from east to west. The multitude of intermittent and ephemeral streams are not shown.

One of the conclusions of the 2014 and 2016 analysis of BCA's water monitoring data by Lewis et al. is: "The average change in turbidity for a watershed that has been 30% cut is +200% and, for a watershed that has been 90% cut it is 3000%. These changes, which are far in excess of the Water Board's Turbidity Standard for the Central Valley region, are unlikely to have been caused by factors other than harvesting, fire, salvage logging, and associated road use." The analyses may be found on our website on this page:

<http://www.thebattlecreekalliance.org/library.html>

As part of the analysis for our 2014 report and 2016 paper, logged areas were identified using 1 meter resolution imagery from the US Department of Agriculture's National Agriculture Imagery Program (NAIP) that was acquired on 8/17/2014 and digitized into a GIS at a scale of 1:24,000 by GIS specialist Curtis Bradley.

Hydrologist Jack Lewis identified areas within the Ponderosa fire area that were salvage logged using Google Earth imagery. Lands zoned for timber production were

identified with GIS data and maps from Shasta and Tehama County. We then intersected the logged and salvaged logged areas with the areas zoned for timber production to determine the proportion of timber producing lands that were logged. Looking at lands zoned for timber production within the watershed, 28,483 acres of 85,385 acres of those lands have been cut, or about 33%, in ~15 years. This has occurred within the current regulations, including your Board's adoption of the Waiver of Waste Discharge Requirements (R5-2003-005) in 2003, and the renewals of it in 2005, 2010, and 2014. The initial draft of your currently proposed order contained this statement as part of the monitoring and reporting attachment: "Additionally, Class I CalWater Planning Watersheds that have been subject to land disturbance activities of 20% or greater over the past 10 years may trigger additional monitoring requirements that will be developed and issued by the Executive Officer on a site-specific basis." But even this vague reference (that further limited the analysis of effects to a 10 year period) to the Rate of Harvest (ROH) was removed from your current version.

The ROH contributes to significant cumulative watershed effects, which have been occurring for nearly 20 years under the current regulations. These effects have not been alleviated by Best Management Practices (BMPs). As Lewis et al. states:

"Cumulative impact assessments in California THPs routinely state that there are no 'reasonably potential significant adverse effects' (possibly after mitigation) on watersheds, soil productivity, biological and other resources; and that any nearby THPs or other projects produce no significant environmental impacts. However, it is well-documented that BMPs do not completely eliminate logging impacts on accelerated sediment delivery (Ziemer and Lisle 1993; GLEC 2010; Klein et al. 2012; Wagenbrenner et al. 2015, 2016). These studies are consistent with our results indicating strongly that BMPs did not prevent major increases in turbidity and, hence, sediment delivery associated with logging in the study area.

A central issue is whether cumulative impacts from a large number of spatially and temporally proximal logging activities deemed "insignificant" in THPs, are significant at the watershed scale. Our results indicate that they are significant, despite BMPs, with negative impacts on water quality, aquatic habitats, and imperiled salmonids. While regulatory agencies have assumed otherwise, removing the forest canopy affects both hydrology and slope stability/erodibility and, regardless of road design or harvest method, increases sediment delivery to waterways, especially in mountainous terrain. The results of this and other studies (e.g. Klein et al. 2012; Lewis et al 2001) indicate that individual logging operations cumulatively elevate sediment delivery to streams. Thus, a high concentration of projects in space and time is likely to degrade water quality and aquatic ecosystems via sedimentation, and it is unlikely that such negative impacts can be prevented or avoided without limiting the total area logged in watersheds."



Fig. 3. Example of sediment impacts still occurring in Battle Creek, June 18th, 2016 after 1" of rain (4 years post-fire and salvage logging, 18 years post-clearcutting)

2. Unpublished industry reports are not reliable evidence.

The largest timberland owner in California, Sierra Pacific Industries (SPI), has been circulating a document for the past several years which discusses their own purported study of post-fire salvage logging and sediment (James 2014). Hydrologist Tom Myers reviewed the earlier version in 2013:

<http://nebula.wsimg.com/83bd6de31f359b050bbb5eec36bb998f?AccessKeyId=01B8D7A67C3CF9F65262&disposition=0&alloworigin=1> and Jack Lewis reviewed the 2014 version in 2016: <http://nebula.wsimg.com/aa5a4911ce3802a3c5901dd13843a9da?AccessKeyId=01B8D7A67C3CF9F65262&disposition=0&alloworigin=1> The 2016 analysis concluded:

"Some of the differences in runoff and erosion among study sites that was reported by SPI are certainly due to reduced infiltration that results from faster runoff on steeper slopes. Slope steepness is universally recognized to be a very important control and no erosion study is complete without a consideration of this factor. There is not a word about slope steepness in the SPI Report and it is an egregious omission."

Several other SPI-produced reports have been reviewed by outside professionals and found to also contain "egregious omissions" (e.g. Peter Miller, NRDC, 2008, review of SPI's "Carbon Sequestration in Californian Forests; Two Case Studies in Managed Watersheds", Sue Britting's 2007 review of SPI's Plant Diversity Study).

In 2015, fish biologist Matt Brown from the US Fish & Wildlife Service wrote to the Regional Water Board regarding his department's concerns regarding increasing fine sediment in Battle Creek http://www.battle-creek.net/docs/gbcwwg/USFWS_MemoIncreaseInFineSedimentSouthForkBattleCreek_final.pdf. His department's observations and analysis is diametrically opposed to SPI's. He wrote:

"...an RBFOW employee responsible for collecting temperature data from temperature loggers deployed throughout the Battle Creek watershed was tasked to collect, in addition to temperature data, information on the condition of SF Battle Creek and related tributaries in regards to increased sedimentation... He noted that there was a considerable increase in sand throughout Battle Creek in this area and significant erosion and evidence of high flows in Soap Creek. This area of the Battle Creek watershed is influenced by effects stemming from the Ponderosa Fire, which occurred in this area 8-31-2012." (Page 2.)

"During trap sampling from all years prior to the Ponderosa fire, the maximum reading was 35.4 NTU's. Since August 2012, the maximum reading was 832 NTU's during a thunderstorm in May 2015. We think that the increase in turbidity is a result of the August 2012 Ponderosa Fire, subsequent salvage logging and other forest management practices, and highly precipitous "Atmospheric River," rain events in December of 2012 and 2014 within the Battle Creek watershed. We plan to further analyze our data as it becomes available.

4) **Additional turbidity measurements.** Turbidity samples have also been collected when the BCJSMP fish traps were not fishing or during the course of other studies. In some cases samples were taken because turbidities were remarkably high. This data was not used in the previous analysis because sampling effort has increased in recent years due to the increase in turbidity. Many samples taken during high flow events since August 2012 were higher than 832 NTU's. The maximum reading of a non-sampling day in February of 2014 was over 1700 NTU's." (Page 6.)

3. Ongoing and interconnected causes and effects.

a. Landslides

Our residency in the area, coupled with our field work, means we spend frequent and regular time on the back roads in the timbered/burnt parts of the watershed. Even so, we see a very small percentage of the land. Yet, we see a marked increase in landslides. Slides are still continuing years after salvage logging, as shown in Figures 4, 5, and 6.



Fig. 4. Sept. 2014. Salvage logged 2012-2013.



Fig. 5. Forwards Mill Road, Dec. 2016. Salvage logged in 2012-2013.



Fig. 6. Rock Creek Rd., Dec. 2016. Salvage logged in 2012-2013.

b. Road closure due to prejudicially finding Shasta County solely responsible for sediment effects.

The regional Water Board sent a letter to Shasta County in 2015, regarding the county road (Rock Creek) which traverses some of the most burned and salvage logged timberland. This letter threatened to levy thousands of dollars of fines per day if the county took no action. The Board of Supervisors voted to close the road for the winter season, built gates, and kept them closed from December 2015 to May 2016. As may be seen in Figures 4, 5 and 6, the effects of salvage logging are ending up in the roads (and potentially being transported to the waterways), but the problems are not being initiated from the roads. The problems originate from the land stripped bare above the roads. As far as we know, no threats of high fine fees were sent to the timberland owners. We don't understand this prejudicial treatment, but consider it highly unsupportable.

4. The Order doesn't consider post-fire salvage logging activity adequately.

Your Order partially addresses post-fire salvage logging. Fire is a natural part of sediment-producing processes; it is also a part of other ecological processes which salvage logging disrupts (Beschta et al. 2004). Fire effects and water effects are inextricably linked. Fire is usually not able to be controlled by humans, but choices about management before and after fire can be controlled, and the Water Board has regulatory authority to do that. Current regulations have no watershed scale limits on ROH for clearcutting and even fewer restrictions on post-fire salvage logging. The removal of the majority of standing trees and their root systems, living or dead, both destabilizes slopes (Klein et al. 2012) and increases GHG emissions (Talberth et al. 2015, Oertela et al. 2016).

There is misrepresentation and ignorance of the best-available science regarding fire being circulated by both CalFire and timber industry sources. Due to this, we incorporate by reference the Center for Biological Diversity's (CBD) comments on the Forest Carbon Plan, which CalFire is the lead agency on. Sections D and E of the CBD comment, pages 14-18, address the "incorrect characterization of fire activity in California's forests", and provide reference papers as proof:

"One of the Plan's core arguments is that California's forests are experiencing uncharacteristically severe and large wildfires that are "out of the historical norm" as a justification for massive increases in thinning in order to reduce fire activity. The Plan also states that forests that have missed fire cycles are burning more severely, and that high severity burn patches are increasing in size. However, the body of scientific studies on fire trends does not support these assertions, and instead demonstrates (1) no increasing trend in fire severity in California's forests, (2) no increasing trend in high-severity patch size, (3) the most fire suppressed forests are not burning more severely, and (4) no clear trends in fire size.

1. Fire severity is not increasing in California's forests.

The Plan repeatedly asserts that fire severity is increasing in California's forests. For this proposition, the Plan cites to three sources (e.g., Miller and Safford 2012, Mallek et al. 2013, unpublished draft Cal Fire report), but omits any mention of the much larger number of recent published, peer-reviewed studies that have found that fire severity is not increasing in California's forests. These studies are summarized in a scientific literature review by Doerr and Santin (2016), which concluded: "For the western USA, [current studies] indicate little change overall [in high-severity fire trends], and also that area burned at high severity has overall declined compared to pre-European settlement."

Specifically, the Plan fails to mention nine studies that analyzed recent trends in fire severity in California's forests in terms of proportion, area, and/or patch size found no significant trend in fire severity: Schwind 2008 (California forests), Collins et al. 2009 (central Sierra Nevada), Hanson et al. 2009 (Klamath, southern Cascades), Dillon et al. 2011 (Northwest California), Miller et al. 2012 (four Northwest CA forests), Hanson and Odion 2014 (Sierra Nevada, southern Cascades), Odion et al. 2014 (eastern and western Sierra Nevada, eastern Cascades), Baker 2015 (California dry pine and mixed conifer forests), and Picotte et al. 2016 (California forest and woodland)."

The Water Board must act to include all science sources, and make management and enforcement decisions based on all the information available, rather than maintaining a narrow focus that allows intensive logging, and its effects, to continue unabated.

5. Concerns regarding General Order effectiveness.

a. General concerns.

Cumulative effects: The primary root cause which is not being addressed by the General Order is the ongoing lack of analyses of the cumulative watershed effects that occur due to multiple projects in a contiguous area. These analyses are required by CEQA, but have been circumvented by the use of planning watersheds. There is nothing in the Draft Order to strengthen the regulations regarding this issue, which is a serious omission. We encourage you to strengthen your order to provide the protections which have been lacking. This could be done by taking a watershed-scale approach, rather than continuing on with the use of the failed "planning watershed" system.

Recent Clean Water Act lawsuits: BCA has been party to legal actions against industrial facilities in Shasta Lake City and Red Bluff in recent months. These were brought to address violations of the General Industrial Storm Water Permit. The facilities are required to monitor pollutant discharges, take four samples each year, and report the analytical results to the Regional Water Board. Although the monitoring was for the most part completed, and EPA benchmark exceedances were self-reported, the Regional Board, as is the case across the State, seems to lack the resources and political will to take any action beyond an occasional letter to the

discharger noting the exceedances. Without government oversight to enforce the standards, protection levels will not be met.

This General Order includes self-monitoring and reporting requirements. Based on our experience investigating storm water violations, BCA has serious concerns regarding actual enforcement of an order based on self-monitoring. Without enforcement, the Order and requirements are meaningless. Specific language needs to be included in the Order with definitions and concrete enforcement measures; those measures must translate into on-the-ground enforcement. That is the purpose of a regulatory agency, not the writing of vague and unenforceable orders which only create more paperwork, but produce no tangible results.

b. Specific concerns.

Page 1 of Attachment B Monitoring and Reporting Program states: Inspection Plans shall be maintained and updated as needed by the Discharger and/or agents thereof and shall be submitted to the Central Valley Water Board upon request.

BCA is very concerned about the phrase “submitted...upon request”. It should be a requirement that the inspection plans and results are submitted automatically. As a public agency responsible for the state’s waters, the Water Board should be receiving these documents and uploading them to the internet for public review to promote transparency, as they do with other reports.

Page 9 of Attachment B Monitoring and Reporting Program states: The Discharger shall report to Central Valley Water Board staff as soon as possible, but no later than 48 hours after detection of any of the following, including, but not limited to:

- Violation(s), threatened or actual, of any applicable water quality objective (i.e. for turbidity, sediment, temperature, dissolved oxygen, pesticides, etc.) caused by:
 - Failed management measures (e.g. watercourse crossing fill failure; watercourse diversion; major road, landing, or skid trail failure within or adjacent to a watercourse protection zone);
 - Failure to implement appropriate management measures;
 - Natural sediment sources (landslide/unstable areas);
 - Legacy timber activities (as assessed during Forensic Monitoring);
 - Non-timber harvesting related land disturbances (as assessed during Forensic Monitoring)

BCA agrees that all of these occurrences should be reported. But, what mechanism is in place so that a discharger actually sees any of those things? In the Battle Creek watershed alone, there are tens of thousands acres of industrial timberland. Without a more specific, detailed plan for **how** to detect these occurrences, this requirement will not accomplish any protection or enforcement measures.

Page 12 of Attachment B Monitoring and Reporting Program states:
POTENTIAL ADDITIONAL MONITORING REQUIREMENTS

Pursuant to California Water Code section 13267, the Executive Officer has the authority to issue site-specific and individually developed monitoring and reporting requirements to any Discharger whose activities could affect the beneficial uses of waters of the state.

Additional monitoring requirements may include, but are not limited to:

- Water column sampling (typically for sediment)
- Physical stream condition assessment for:
 - Gravel Embeddedness –Degree gravel is embedded with sand or finer sediments;
 - Pool Sedimentation –Degree of sediment depositions in pools;
 - Stream Channel Aggradation –Degree that stream channel has been raised by sedimentation;
 - Streambank Cutting, Mass Wasting and Stream Downcutting;
 - Stream-Side Vegetation;
- Streamflow data (current, historical, peak flows);
- Bioassessment.

As mentioned on page 4, this paragraph has been deleted: "Additionally, Class I CalWater Planning Watersheds that have been subject to land disturbance activities of 20% or greater over the past 10 years may trigger additional monitoring requirements that will be developed and issued by the Executive Officer on a site-specific basis." Although it only stated that it "may trigger additional monitoring requirements" it was a step in the direction of taking an action regarding high amounts of watershed scale disturbance. But, you have removed even that small step. BCA has also collected much published literature that shows the long term effects of disturbance; the 10-year limit is very low for the length of time that effects can last (Karraker et al. 2006, Reid et al. 2009, Klein et al. 2012, Kuras et al. 2012, Cafferata et al. 2013). As noted above (page 10, a.), the use of the smaller CalWater Planning Watersheds (subwatersheds) only serves to ignore the honest appraisal of cumulative impacts on a whole watershed.

As can be seen on the following map of the Battle Creek watershed (Fig. 7), the Planning Watersheds (white boundaries) are very small compared to the overall watershed size (dark yellow boundary). By dividing the larger watershed into ever-smaller sub-drainages, the overall health of water and watersheds is being ignored. This was clearly described in Dunne et al. (2001):

"The resulting 'postage-stamp', or 'parcel-by-parcel', approach, in which only the immediate project area of a single, small timber harvest is ever reviewed—as all other reviewers have said—does not capture the cumulative influence of multiple harvests over a long period of time in a large, complex watershed. The Little Hoover Commission (1994, p. 55), quoting the State Water Resources Control Board, arrived at the same conclusion, referring to the results as 'Inadequate, 'boilerplate' analyses and mitigation measures."

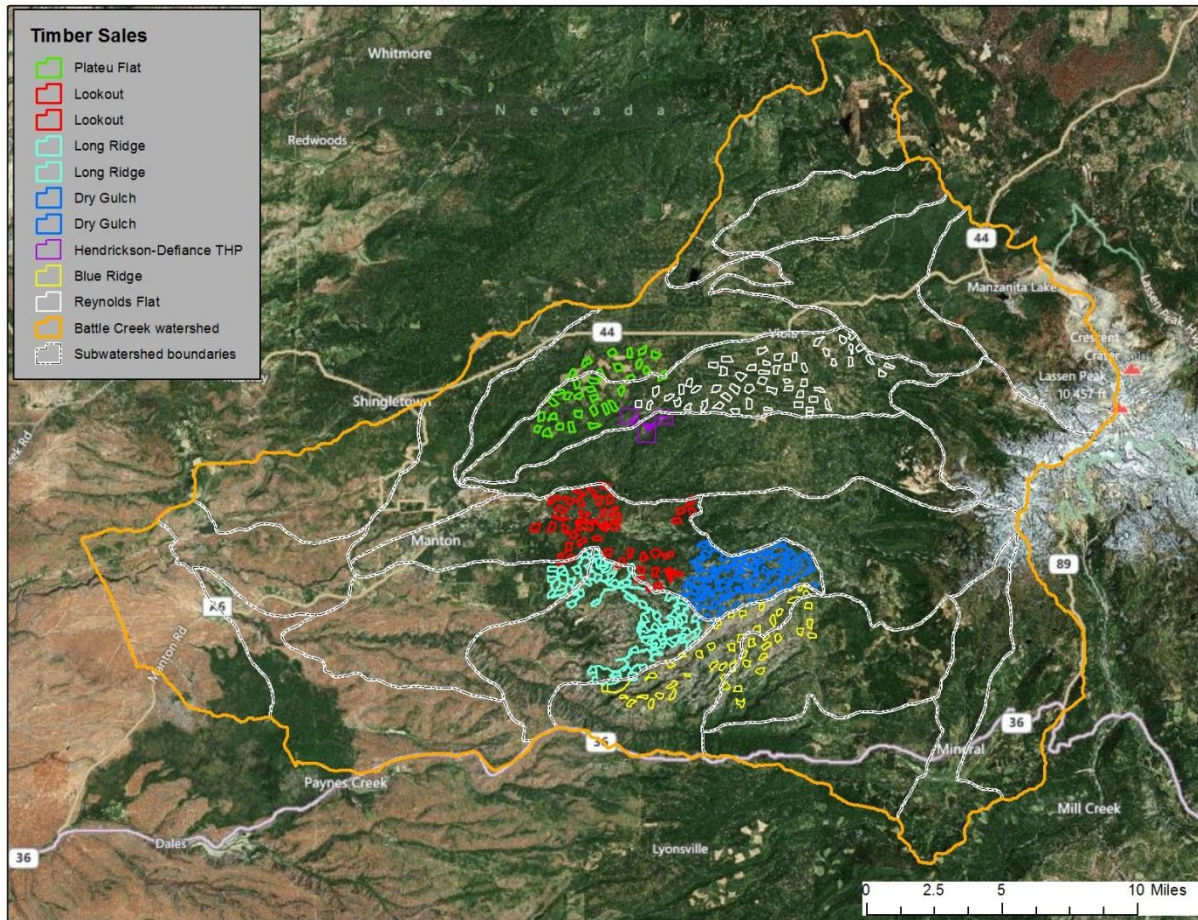


Fig. 7. Battle Creek watershed (yellow boundary line) with planning watershed boundaries (white with black dashed lines).

Figure 8 reveals the continuing upward trend in suspended sediment in the Battle Creek watershed. The steadily climbing trend shows more sediment being transported by storms of less magnitude and intensity. This is consistent with literature regarding peak flows increasing in response to more loss of forest canopy (Lewis et al. 2001, Kuras et al. 2012).

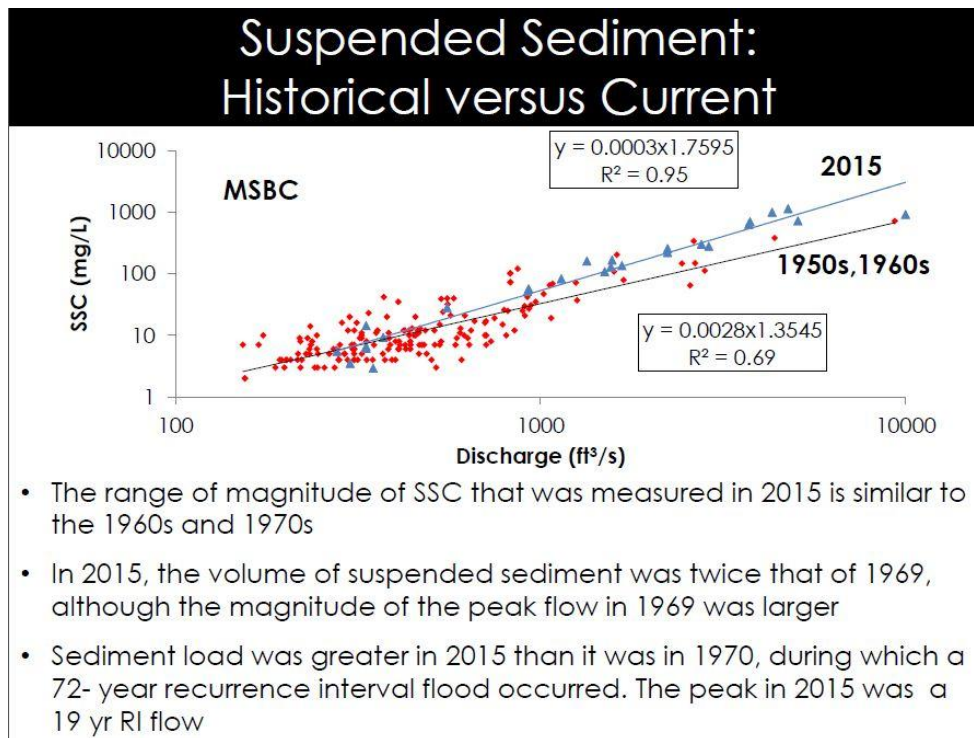


Fig. 8. Graph of Battle Creek sediment analysis from Henkle et al. (2016).

6. Summary

There is overwhelming evidence which demonstrates:

- Current BMPs are failing to protect the waters of the State.
- Current regulations are failing to protect the waters of the State.
- This order has no specific, measurable, enforceable on-the-ground standards to be met. It instead depends on the tiny percentage of chance that some random person will pass by a problem area in the 16 million acres of forested land in the CVRWQ area and report it. Somewhere far beyond the proverbial “finding the needle in the haystack”, isn’t it?

The forested watersheds of California will not benefit from an order which only requires more paperwork hoops for forest landowners to jump through, while the proven failing practices on the ground continue on the same trajectory. The lack of a full CEQA review and the ongoing extension of the Waiver of Waste Discharge Requirements over the past 15 years have allowed many forested watersheds of California to be irreparably damaged. We believe that it is your Board’s duty to write a strong order which will make a real difference in providing protection to the waters of the State.

Sincerely,



Marily Woodhouse, Director

battlecreekalliance@gmail.com

See the real effects of current regulations on the land. Our documentary “Clearcut Nation” is here: <https://youtu.be/Dde1dv86M7Q>

References

Baker WL (2015) Are high-severity fires burning at much higher rates recently than historically in dry-forest landscapes of the Western USA? PLoS ONE 10(9): e0136147

Beschta RL, Rhodes JJ, Kauffman JB, Gresswell RE, Minshall GW, Frissell CA, Perry DA, Hauer R, Karr JR (2004) Postfire management on forested public lands of the western United States. Conserv Biol 18:957–967. <http://dx.doi.org/10.1111/j.1523-1739.2004.00495.x>

Bond S, McHenry R (2011) CSPA Assessment of Battle Creek Monitoring Data. Report prepared for Battle Creek Alliance, Manton, CA.

<http://nebula.wsimg.com/1b7d46bf0c6a12ec56b65ba29f975105?AccessKeyId=01B8D7A67C3CF9F65262&disposition=0&alloworigin=1>

Britting S (2007) Letter to CALFIRE regarding SPI plantation species diversity study.

<http://nebula.wsimg.com/18d6a90028ed1207a3ecb55bcc1a42f3?AccessKeyId=01B8D7A67C3CF9F65262&disposition=0&alloworigin=1>

Cafferata PH, Reid LM (2013) Applications of long-term watershed research to forest management in California: 50 years of learning from the Caspar Creek Experimental Watersheds. California Department of Forestry & Fire Protection, California Forestry Report No. 5.

http://www.fire.ca.gov/resource_mgt/downloads/reports/California_Forestry_Report_5.pdf. Accessed 4/11/2017

Collins BM et al. (2009) Interactions among wildland fires in a long-established Sierra Nevada natural fire area. Ecosystems 12:114–128

Dillon GK, et al. (2011) Both topography and climate affected forest and woodland burn severity in two regions of the western US, 1984 to 2006. Ecosphere 2: Article 130

Doerr SH and Santin C (2016) Global trends in wildfire and its impacts: perceptions versus

realities in a changing world. *Philosophical Transactions Royal Society B* 371: 20150345

Dunne T, Agee J, Beissinger S, Dietrich W, Gray D, Power M, Resh V and Rodrigues K, (2001) A Scientific Basis for the Prediction of Cumulative Watershed Effects. Wildland Resources Center, University of California, Berkeley, California, 103 p.

Hanson CT et al. (2009) Overestimation of fire risk in the Northern Spotted Owl Recovery Plan. *Conservation Biology* 23: 1314–1319

Hanson CT and Odion DC (2015) Sierra Nevada fire severity conclusions are robust to further analysis: a reply to Safford et al. *International Journal of Wildland Fire* 24: 294-295

Henkle JE, Pasternak GB, Gray AB (2016) 2015 Battle Creek Watershed Hydrology and Sediment Assessment, Final Technical Report.
http://www.battlecreek.net/docs/monitoring/r5_bcw_ucd_jan2016.pdf

James C (2014) Post-wildfire Salvage Logging, Soil Erosion, and Sediment Delivery—Ponderosa Fire, Battle Creek Watershed, Northern California, Preliminary Results. Sierra Pacific Industries.
http://www.spi-ind.com/research/PostWildFireSalvageLoggingPrelimSummary_CJAMES_SPI.pdf.

Karraker NE, Welsh HH Jr. (2006) Long-term impacts of even-aged timber management on abundance and body condition of terrestrial amphibians in Northwestern California. *Biological Conservation* 131: 132-140.

Klein RD, Lewis J, Buffleben MS (2012) Logging and turbidity in the coastal watersheds of northern California. *Geomorphology* 139:136-144

Kuras PK, Alila Y, Weiler M (2012) Forest harvesting effects on the magnitude and frequency of peak flows can increase with return period. *Water Resources Research*, Vol. 48, W01544,
[doi:10.1029/2011WR010705](https://doi.org/10.1029/2011WR010705)

Lewis J, Keppeler ET, Ziemer RR, Mori SR (2001) Impacts of logging on storm peak flows, flow volumes and suspended sediment loads in Caspar Creek, California. In: Mark S. Wigmosta and Steven J. Burges (eds.) Land use and watersheds: Human influence on hydrology and geomorphology in urban and forest areas, Water science and application Volume 2, American Geophysical Union, Washington, DC, pp. 85-125

Lewis J, Bradley C (2014) An Analysis of Turbidity in Relation to Timber Harvesting in the Battle Creek Watershed, northern California September 2014 http://www.battle-creek.net/docs/gbcwsg/battle_creek_turbidity_report_10_1_14%20Lewis.pdf

Lewis J (2016) Topographic Characterization of Swales in Sierra Pacific Industries' Ponderosa Post-Fire Sediment Study, Shasta County, California
<http://nebula.wsimg.com/aa5a4911ce3802a3c5901dd13843a9da?AccessKeyId=01B8D7A67C3CF9F65262&disposition=0&alloworigin=1>

Miller JD et al. (2012) Trends and causes of severity, size, and number of fires in northwestern California, USA. *Ecological Applications* 22: 184-203

Miller P (2008) A Review of SPI's study: "Carbon Sequestration in Californian Forests; Two Case Studies in Managed Watersheds".
<https://nebula.wsimg.com/627cba0847ea713e1a52945d37eceb23?AccessKeyId=01B8D7A67C3CF9F65262&disposition=0&alloworigin=1>

- Myers T (2012) Cumulative watershed effects of timber harvest and other activities: Battle Creek Watershed, Northern California. Report prepared for Battle Creek Alliance, Manton, CA. http://www.thebattlecreekalliance.org/uploads/myers_FINAL_battle_creek_watershed_analysis_070312.pdf.
- Myers, T (2013) Review of Study: Inspection of Sierra Pacific Industries' Ponderosa Post-Fire Sediment Study, Shasta County, California <https://nebula.wsimg.com/83bd6de31f359b050bbb5eec36bb998f?AccessKeyId=01B8D7A67C3CF9F65262&disposition=0&alloworigin=1>
- Odion DC et al. (2014) Examining historical and current mixed-severity fire regimes in Ponderosa pine and mixed-conifer forests of western North America. *PLoS ONE* 9(2): e87852
- Oertela C, Matschullata J, Zurbaa K, Zimmermann F, Erasmib S (2016) Greenhouse gas emissions from soils—A review. *Chemie der Erde* 76 327–352 <http://dx.doi.org/10.1016/j.chemer.2016.04.002>
- Picotte JJ et al. (2016) 1984–2010 Trends in fire burn severity and area for the coterminous US. *International Journal of Wildland Fire* 25: 413–420
- Reid LM, Dewey NJ, Lisle TE, Hilton S (2009) The incidence and role of gullies after logging in a coastal redwood forest. *Geomorphology* doi:10.1016/j.geomorph.2009.11.025
- Schwind B (2008) Monitoring trends in burn severity: report on the Pacific Northwest and Pacific Southwest fires (1984 to 2005). US Geological Survey
- Talberth J, DellaSala D, Fernandez E (2015) Clearcutting our Carbon Accounts. Global Forest Watch Report. <http://sustainable-economy.org/wp-content/uploads/2015/11/Clearcutting-our-Carbon-Accounts-Final-11-16.pdf>
- USFWS (US Fish and Wildlife Service) (2015) Memo to California Regional Water Quality Board Re: Increase in fine sediment in South Fork Battle Creek. USFWS, Red Bluff, CA
- Wagenbrenner JW, MacDonald LH, Coats RN, Robichaud PR, Brown, RE (2015) Effects of post-fire salvage logging and a skid trail treatment on ground cover, soils, and sediment production in the interior western United States. *For Ecol Manage* 335:176–193. <http://dx.doi.org/10.1016/j.foreco.2014.09.016>
- Wagenbrenner JW, Robichaud PR, Brown RE (2016) Rill erosion in burned and salvage logged western montane forests: Effects of logging equipment type, traffic level, and slash treatment. *J Hydrol* 541(B):889–901. <http://dx.doi.org/10.1016/j.jhydrol.2016.07.049>
- Ziemer RR, Lisle TE (1993) Evaluating sediment production by activities related to forest uses--A Northwest Perspective. In: *Proceedings Technical workshop on sediments, 1992, Corvallis, Oregon*. Terrene Inst., Washington, DC pp. 71–74